# Medical Biology

## L- 1 1st Stage

**DEPARTMENT OF ANATOMY**
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# L-1: Introduction to Biology

## Objectives :

- Define the term “Biology”.
- Define the term “Cell Biology”.
- History
- The levels of biological organization.
- The basic characteristics of living things.
- Cell types: Compare between prokaryotic and eukaryotic cells.
- Know the tools of cell biology.

# Biology

**Biological science**: The science that studies living organisms.

**Genetics**: The branch of biology that studies hereditary and variation in organisms.

**Histology**: The branch of biology that studies the structure and function of organs tissues.

**Cell biology** also called **cellular biology** or **Cytology** is a branch of biology that studies the structure, function, and behavior of cells. All living organisms are made of cells.

**A cell: is the basic unit of life that is responsible for the living and functioning of organisms.**

- Cell biology encompasses both **prokaryotic** and **eukaryotic** cells and study of cell metabolism, cell communication, cell cycle, biochemistry, and cell composition.

## History

Cells were first seen in 17th century Europe with the invention of the compound microscope.

- In 1665, **Robert Hooke** termed the building block of all living organisms as "cells" (published in *Micrographia*) after looking at a piece of cork and observing a cell-like structure,- however, the cells were dead and gave no indication to the actual overall components of a cell.

-A few years later, in 1674, **Anton Van Leeuwenhoek** was the first to analyze live cells in his examination of algae. All of this preceded the cell theory which states that all living things are made up of cells and that cells are the functional and structural unit of organisms.

-This was ultimately concluded by plant scientist, **Matthias Schleiden**- and animal scientist **Theodor Schwann** in 1838, who viewed live cells in plant and animal tissue, respectively.

-19 years later, **Rudolf Virchow** further contributed to the cell theory, adding that all cells come from the division of pre-existing cells- .Viruses are not considered in cell biology – they lack the characteristics of a living cell, and instead are studied in the microbiology subclass of virology.

# The Levels of biological Organization

- **the simplest building blocks of matter:**

1- subatomic particles,

2- atoms

3- molecules.

The biological levels of organization of living things arranged from the simplest to most complex are:

**Atom:** The smallest part of an element made of protons, neutrons, and electrons, e.g. Carbon  .(C)

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.**Molecule:** Two or more atoms bonded together, e.g. Water 

.**Organelle:** A small part inside a cell that has a specific job to do. **e.g**. Mitochondrion 

.**Cell:** is the basic unit of structure and function in a living thing. e.g. nerve cell 

**Tissue:** Many cells of the same type working together to perform a function. e.g. nervous  .tissue

**Organ:** Different tissues working together to form a structure with a specific function. e.g.  .brain

**Organ System:** Different organs working together to perform a major process in an organism. 
.e.g. Nervous System

. **Organism:** A single living thing that has all of the characteristics of life. e.g. human 

.**Population:** Many organisms of the same type (species) in the same place at the same time 

**Community:** All of the different living things (organisms) in the same place at the same time. 
.(human, animals and plants)

**Ecosystem:** All of the living things (biotic) and the non-living factors (abiotic) in the same 
.place at the same time

.**Biosphere** : The part of the earth's surface where living things can be found 

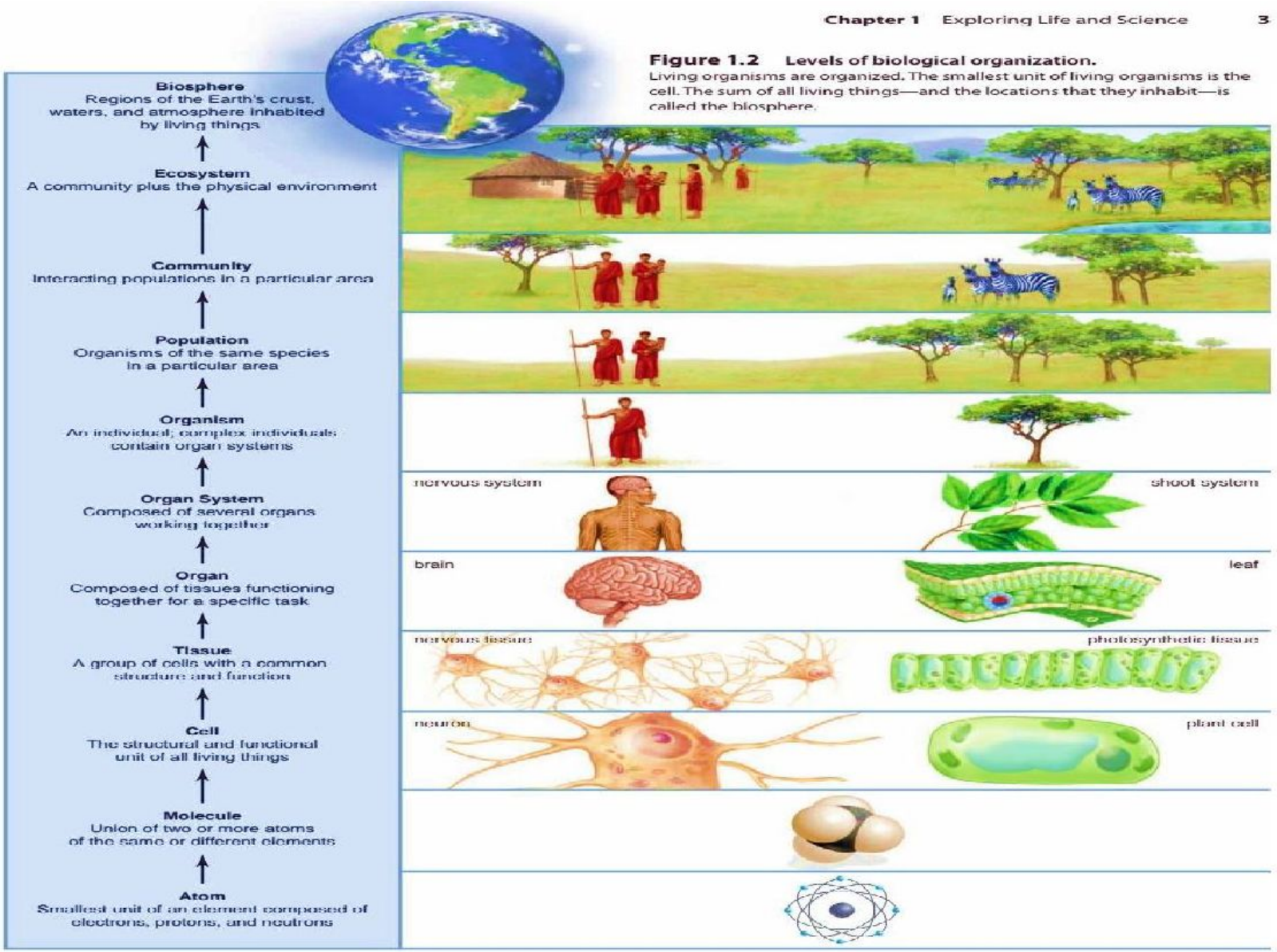


**Figure 1.2** **Levels of biological organization.**
Living organisms are organized. The smallest unit of living organisms is the cell. The sum of all living things—and the locations that they inhabit—is called the biosphere.

# the basic characteristics of living things.

Living organisms have certain characteristics that distinguish them from nonliving objects:

**Organization**: Living things are highly organized. All living organisms are **.1**
.made up of one or more cells, which are considered the basic units of life

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**Homeostasis**: Regulation of the internal environment to maintain a constant **.2**
state. Stable internal conditions of pH, temperature, water balance, etc. e.g.
.sweating to reduce temperature

.**Adaptation**: The ability to change over time in response to the environment **.3**

**Response to stimuli:** Organisms respond to stimuli (Temperature, Water, **.4**
.Food Supplies, etc.) in order to survive & reproduce

**Metabolism**: Is the term used to describe all chemical reactions **.5**
.involved in maintaining the living state of the cells and the organism

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**Reproduction:** The ability to produce new individual organisms, **.6**
either

asexually from a single parent organism, or sexually from two parent
.organisms

**Growth and Development:** Growth recognized by an increase in **.7**
size and often the number of cells. Development refers to all changes
.that occur during life

## The Cell

□ **Cell:** is the basic unit of structure and function in a living thing.

□ Cell biology (also cellular biology or cytology) is a branch of biology studying the structure and function of the cell.

□ **Structural Organization of Cells**

All cells have three basic parts:

1. Cell membrane: that keeps the inside and outside separate.

2. DNA-containing region: that holds the instructions to run the processes of life.

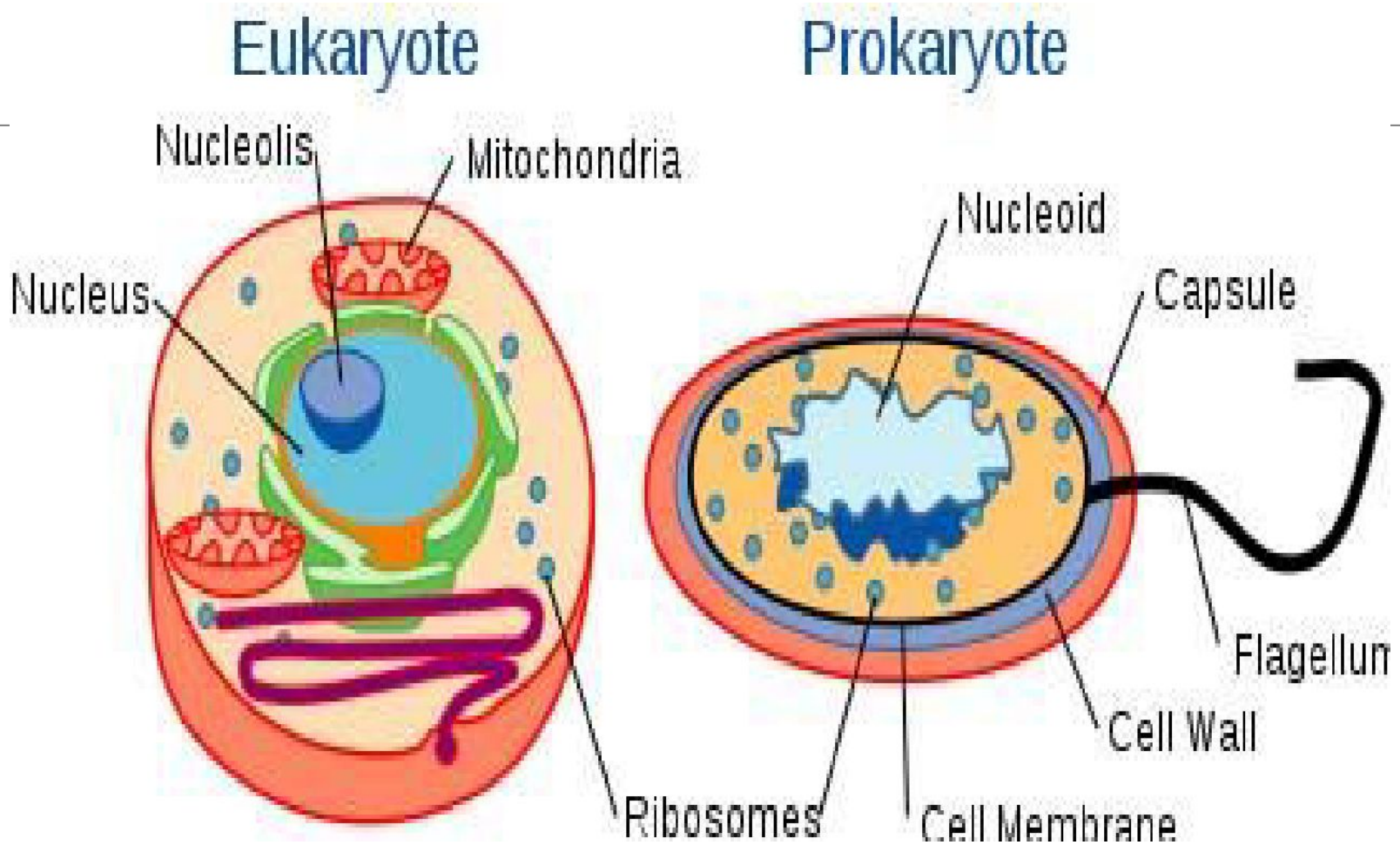
3. Cytoplasm: a semi-fluid region containing the rest of the cell's machinery.

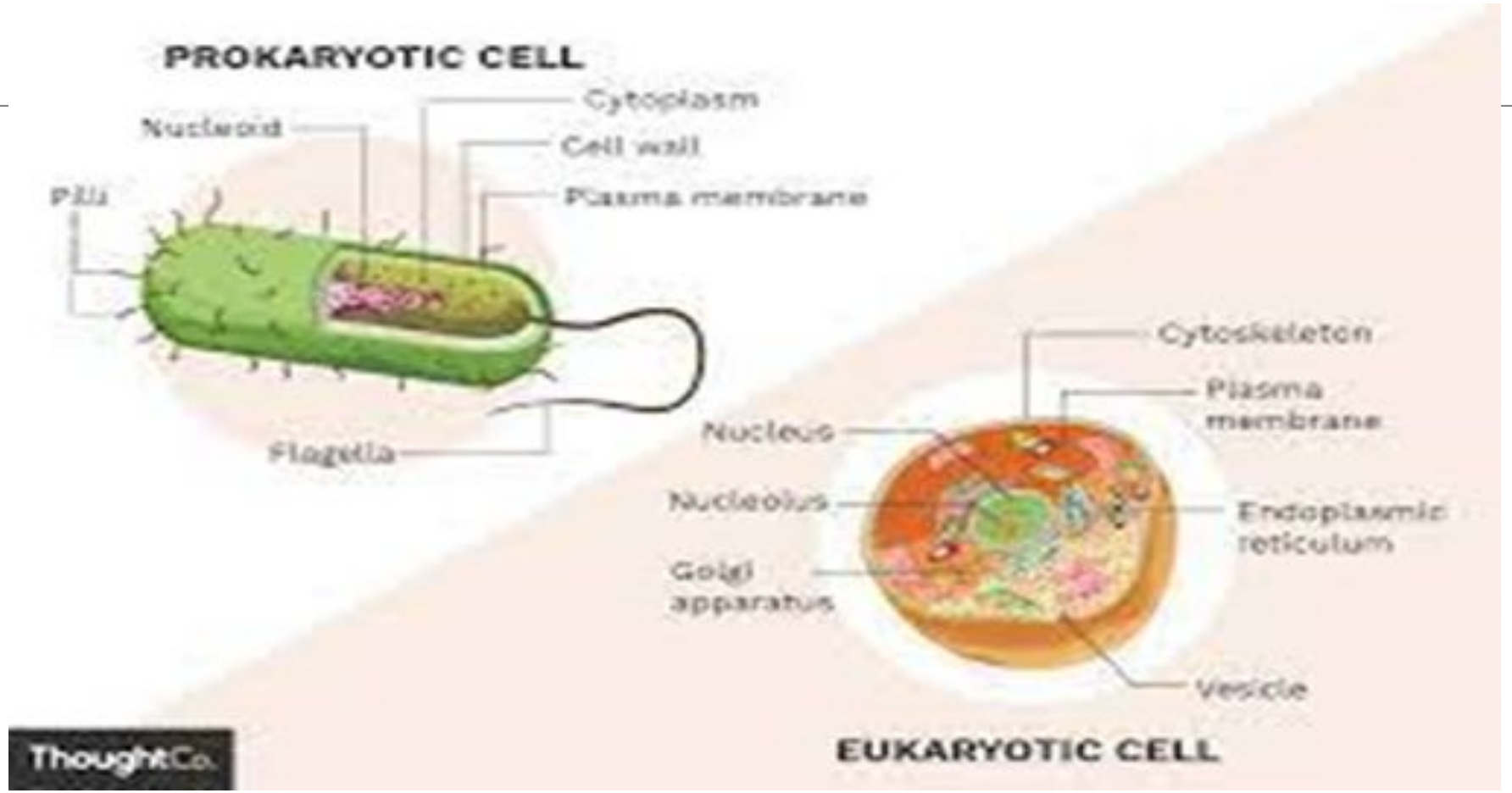
**Types of cells:**

There are two basic types of Cells, Prokaryotic and Eukaryotic.

1. A prokaryotic cell is a simple, single-celled (unicellular) organism that lacks a nucleus, or any other membrane-bound organelle.

2. A eukaryotic cell is a cell that has a membrane-bound nucleus and other membrane-bound compartments or sacs, called organelles.


Eukaryote
Prokaryote
Nucleolis
Mitochondria
Nucleus
Nucleoid
Capsule
Flagellum
Cell Wall
Ribosomes
Cell Membrane


PROKARYOTIC CELL
Cytoplasm
Nucleoid
Cell wall
Pili
Plasma membrane
Flagella
Cytoskeleton
Plasma membrane
Nucleus
Nucleolus
Endoplasmic reticulum
Golgi apparatus
Vesicle
EUKARYOTIC CELL
ThoughtCo.

Comparison between prokaryotic and eukaryotic cells:

 **Similarities**:

1. They both have DNA as their genetic material.

2. Both cells have a plasma membrane.

3. They both have ribosomes.

4. They have similar basic metabolism.

# Differences

| S.No. | Prokaryotes | Eukaryotes |
|---|---|---|
| (*i*) | Most prokaryotes are unicellular. | Most eukaryotes are multicellular. |
| (*ii*) | The nucleus is poorly defined due to the absence of a nuclear membrane. | The nucleus is well defined and is surrounded by a nuclear membrane. |
| (*iii*) | Nucleolus is absent. | Nucleolus is present. |
| (*iv*) | Cell organelles such as plastids, mitochondria, golgi bodies, etc. are absent. | Cell organelles such as plastids, mitochondria, golgi bodies, etc. are present. |
| (*v*) | Bacteria and blue-green algae are prokaryotic cells. | Fungi, plant, and animal cells are eukaryotic cells. |

**Summary**

- Biology is a natural science concerned with the study of life and living organisms.
- All living organisms share common characteristics:

1.Organization

2.Homeostasis

3. Metabolism

4. Growth and Development

5. Adaptation:

6. Response to stimuli

7. Reproduction

- Living organisms have levels of organization—atoms, molecules, cells, tissues, organs, organ systems, organisms, populations, community, ecosystem, and biosphere.
- Cell biology is a branch of biology studying the structure and function of the cell.
- There are two basic types of Cells:

1. A prokaryotic cell is a simple, single-celled (unicellular) organism that lacks a nucleus, or any other membrane-bound organelle.

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*Dr.Hans*


THANK YOU
FOR LISTENING